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BUSINESS RESEARCH AND INNOVATION ACTIVITY IN CUMBRIA: A REVIEW OF EVIDENCE

Submitted to:

Cognitive Cumbria

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EXECUTIVE SUMMARY

1. This report examines the status of the County of Cumbria with regard to research and innovation activity. For the purpose of this report, innovation is defined in a business context relating to new or significantly improved products, business processes, business organisation or strategies.
2. A recent study of measures of innovation (BIS 2015a) suggests that across a wide range of such indicators, Cumbria tends to be ranked in the lowest quartile. This implies that the County experiences relatively low comparative advantage for innovation in comparison with other local areas across England (LEP areas).
3. This analysis shows Cumbria in a favourable light with regard to occupational structure and workplace earnings. However, it also shows the County is not well placed with regard to some key aspects of funding, knowledge assets, enabling structures and general business environment.
4. These findings are consistent with analysis of industrial structure and occupations. Businesses in sectors that are generally regarded as "knowledge-intensive" are under-represented in the County compared with other local authority areas in the North of England. Cumbria has a relatively low rate of new business start-up.
5. Latest ranked data on R&D expenditure indicates the dominance of the south-east of England. Northern cities are mostly in mid-table while the more peripheral and rural counties lag behind. Cumbria is ranked 35th with annual expenditure dedicated to formal private sector R&D amounting to only £65m.
6. Data on patents reveals a similar picture. The average annual number of patents per 100,000 residents attributed to Cumbria over the 5 years from 2007 to 2011 was 4.4 and the County ranked 34th out of the 39 LEPs.
7. Innovative behaviour within small and medium-sized businesses is better captured through the UK Innovation Survey. Latest reports on this data at the scale of LEP areas indicate that the proportion of businesses engaged in innovative activities is also low in Cumbria (ranked 38th out of 39 LEPs).
8. Qualitative evidence and case studies can be used to demonstrate, however, that where research and innovation activity does take place in Cumbria, it can be high quality and significant for business growth and competitiveness.
9. It is evident from Sir Andrew Witty's Review of Universities and Growth (BIS 2013) and the BIS (2015a) report on Smart Specialisation in England that research and innovation in the nuclear sector is a national priority and that any discussion on the sector would inevitably involve expertise, skills and capacity within Cumbria.
10. A key development in this sector concerns investment in the National Nuclear Laboratory (NNL) which operates at a number of locations across the UK. The core of NNL, however, is the Central Laboratory which is being developed at the Sellafield site close to the existing facilities at the Winscale Laboratory. When fully commissioned, it is anticipated that the Central Laboratory will have the potential to make a significant contribution to global nuclear research.
11. Significant levels of funding have already been drawn into the County in the nuclear sector. NNL, the Nuclear Decommissioning Authority (NDA) and Sellafield Ltd are currently collaborating with the Engineering & Physical Sciences Research Council (EPSRC) and a consortium of UK universities on a programme of research with an overall value of £8-9m. This funding provides a basis for growing the research community in West Cumbria.

12. NNL has particular links with Manchester University due to the presence of the Dalton Institute in West Cumbria. The Dalton Cumbrian Facility (DCF) is a state-of-the-art research facility located on the Westlakes Science and Technology Park with facilities to carry out high-level research in radiation science and nuclear engineering.

13. Cumbria can also claim considerable innovative capacity related to submarines and subsea technologies. BAe Systems Submarines is the UK's sole manufacturer of the Astute class of nuclear-powered submarines provided for the UK Royal Navy. These specialist submarines are built at the Barrow Shipyard but depend on a complex supply chain and research and technical capability across BAe Marine Division which operates from 13 sites across the UK.

14. Cumbria also has prominent capability in subsea technologies through Tronic which was acquired by Siemens in 2012. Tronic is a world-leading producer of subsea connectors for the oil and gas industry. New investment is being made at the Ulverston site in specialist production facilities and an office complex to house new technical capabilities and capacity.

15. Cumbria hosts production sites operated by many large firms in other sectors that have strong technical departments engaged in research and product development. Examples include the Pirelli Tyre factory in Carlisle and the research activities in Innovia which was formed in 2004 as a management buyout from former owners UCB Films based in Wigton.

16. There are also many innovative smaller and medium-sized enterprises (SMEs) operating in Cumbria. These include companies that design and build specialist equipment (robotics, hydropower, renewables) as well as a wide range of innovative businesses involved in other sectors including tourism and food & drink production.

17. Public sector support for business innovation operates at a variety of scales of intervention. At the County level, Cumbria Local Enterprise Partnership (LEP) has responsibility for economic development including coordination of actions to promote innovation.

18. Local institutional capacity has recently been strengthened by the formation of Innovus which supports research and innovation activity across the County.

19. In West Cumbria, businesses also benefit from support provided by programmes funded through Britain's Energy Coast (BEC). The private sector-led Business Cluster also facilitates the dissemination of information particularly in the nuclear supply chain.

20. Cumbrian businesses can also access some support from resources provided at the national level. These include prominently schemes and programmes delivered by Innovate UK such as Innovation Vouchers, R&D grants and Knowledge Transfer Partnerships (KTPs). There are other generic business support programmes run by BIS as part of the Government's Growth Agenda that could be used to support innovation.

21. In conclusion, it can be seen across a range of indicators that research and innovation activity is much less widespread in Cumbria compared to other local areas in England. Specific case studies demonstrate, however, that where such activity does take place, it can be high quality and leading edge in particular sectors.

22. These conclusions suggest that there is a need to gather more systematic information about the scale of existing R&D and business innovation activity across the County that underpins economic growth. Further research is also needed to improve understanding of innovation in a broader context in terms of improvements that generate beneficial social and environmental outcomes for Cumbria.

1. Introduction

The purpose of Cognitive Cumbria is to improve understanding of the local and regional knowledge processes that encourage the growth and quality of innovative and creative businesses across Cumbria. This report has been prepared by the Centre for Regional Economic Development (CRED) at the University of Cumbria to contribute towards this overall purpose. Definitions of research and innovation are specified and applied to the County of Cumbria using relevant available data and sources of information. The report concludes by considering future prospects for innovation and business performance in Cumbria.

This report has been commissioned at a time when there is intensified interest in research activity, technological development, science and innovation at virtually all levels of economic policymaking. At the European scale, research priorities specified in the Horizon 2020 and also European Regional Policy give much greater attention to understanding the process of research and innovation than in the recent past. So too at national level, UK Government is placing much greater emphasis on business innovation as a key to unlocking productivity and international competitiveness:

> *Business innovation is a vital ingredient in raising the productivity, competitiveness and growth potential of modern economies. Providing the right economic conditions for and using appropriate policy instruments to encourage innovation in the UK is a central objective. Measuring the level of innovation activity in the UK and identifying where policy might be best targeted contributes to the pursuit of that objective.*[1]

Vince Cable, Secretary of State for Business, Innovation and Skills under the Conservative-Liberal Coalition Government, in a speech delivered in July 2014 (BIS, 2014a), stated that "Of the productivity growth that took place in the UK between 2000 and 2008, one third (32%) was attributable to changes in technology resulting from science and innovation. Innovative firms are also more resilient and more likely to export." More recently, Science Minister, Jo Johnson (BIS, 2015b), has also stated in a speech in July 2015, that "UK taxpayers invest £10 billion a year in research and innovation…and we will invest new capital on a record scale – £6.9 billion in the UK's research infrastructure up to 2021 – which will mean new equipment, new laboratories and new research institutes."

Aims of Research

In this policy context, the purpose of this report is to assist Cognitive Cumbria in shaping ideas concerning the nature of innovative performance and capacity in Cumbria by addressing the following research aims:

- To develop definitions of innovation and innovative businesses
- To test the use of available data to measure levels of innovation in the County
- To provide a baseline of current innovation, support schemes and funding schemes for innovation in Cumbria
- To examine the factors that influence levels of business innovation in Cumbria.

[1] UK Innovation Survey (2015)

2. Definitions and Typologies: Innovation

The term "innovation" is commonly used to refer to the introduction of new products, processes or methods of organisation in business and the economy in general. The concept of innovation, however, has spawned a large and complex academic literature and numerous theories that stretch back at least to seminal works of the economist Joseph Schumpeter (1934) and, more recently, those associated with the industrial economists Freeman (1982) and Lundvall (1992). Discussion has also permeated regional economics where there is now an extensive literature on the concept of regional innovation systems (RIS) and the role of regional and local economies in shaping innovation processes.

In policy terms, in the UK, a key recent publication by the Department for Business Innovation and Skills (BIS) has attempted to define innovation and operationalise this in terms of measurement across UK localities (BIS 2015a). This document emphasises the fact that there are many different definitions that vary in detail. However, most definitions recognise that "innovation" goes well beyond conventional definitions of "Research & Development". It can include, for instance, improvements in business processes, work organisation as well as service quality:

- *"the implementation of a new or significantly improved product (good or service) or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations" (OECD, 2005).*

- *"the application of knowledge to the production of goods and services" and as meaning "improved product and service quality and enhanced process effectiveness" (BIS, 2014a).*

- *"activity that is new in its context, such as implementation of a new or significantly improved product, service or process, a new marketing method or new organisational methods" (BIS, 2014).*

There is also implicit in these definitions that innovation can involve *both tangible and intangible outputs* but must, in some way, lead to, or be associated with some *measurable improvement in performance*, such as growth in output or value added. This is implied in the definitions adopted by NESTA:

- *"the growth in output or value added created by new products and services, processes and ways of working over and above the contributions of physical capital and labour." (NESTA, 2012).*

These various points are captured in the definition of innovation activity used in the UK Innovation Survey which defines innovation in the following terms:

- The introduction of a new or significantly improved product (good or service) or process;
- Engagement in innovation projects not yet complete or abandoned;
- New and significantly improved forms of organisation, business structures or practices and marketing concepts or strategies;
- Activities in areas such as internal research and development, training, acquisition of external knowledge or machinery and equipment linked to innovation activities.

Clearly, this definition raises further questions about the meaning of terms used such as what constitutes "newness" and "significant improvement". Previous studies have tended to manage these questions pragmatically by developing *typologies* of innovations linked to

particular measurements or observations, such that the precise definition is defined *in context.* We adopt a similar approach here.

Measuring Business Innovation in local areas in the UK

The most comprehensive attempt to develop and apply aggregate indicators related to innovation can be found in a recent BIS report prepared by Liverpool John Moores University (BIS, 2015d). This study had the benefit of access to datasets and levels of spatial disaggregation in regular data series that are not routinely available in published form. The study developed indicators covering the following six aspects of what are described as "local comparative advantages in innovation":

- **Money**: A key input into all parts of the system, used to invest in infrastructure, new knowledge, absorptive capacity and innovation.
- **Talent**: The human capital required to demand, develop, share and exploit new and existing knowledge.
- **Knowledge assets**: Intermediary outputs of the system that provide an indicator of its quality and potential and that are relatively easy to measure.
- **Structures and incentives**: The institutions and interconnections that determine how effectively the actors in the system work together to generate outcomes.
- **Broader environment**: The economic and societal context with which the science and innovation system interacts.
- **Innovation outputs**: Measurable outputs that can be used as proxies for the ultimate outcomes sought, i.e. economic and societal benefits.

The outcome of the study was a sequence of tables that ranked the 39 LEP areas in England across a range of indicators. These indicators and the ranks for Cumbria LEP are shown in Table 1. As can be seen, across the whole picture, Cumbria tends to be ranked in the lowest quartile (rank 30 and below) for most indicators (16 of the 23 indicators). This is reflected in the average rank of 30.6. This implies that the comparative advantage for innovation in Cumbria as measured in these terms is relatively low in relation to other local areas across England.

While this general conclusion is fairly negative, the analysis does show that Cumbria has some advantages for innovation, including higher ranking in terms of occupational structure, (% working in science and engineering professions ranked 13=), workplace earnings (ranked 19) and employment rates (19=). Even so, it is evident that Cumbria is not well-placed with regard to some very key factors including inputs of money, knowledge assets, enabling structures and some key aspects of the general environment (digital connectivity in particular, though this has undoubtedly improved since 2014). One indicator ranks Cumbria in the highest rank – travel-to-work times 2012. This is intended to measure variations in transport accessibility. While this might be an appropriate indicator to compare cities with one another, it is clearly spurious when applied to Cumbria and is unlikely to have any enabling influence over levels of innovation.

Table 1: Comparative advantage for innovation in Cumbria

		Cumbria Rank
Inputs of money	Business Enterprise R&D expenditure (BERD) by FTE 2013	31
	Innovate UK grants £s per FTE 2010-15	39
Inputs of talent	% in "science, engineering & technology profs" 2013-14	13=
	% residents qualified NVQ4+ 2013	25
	N Full time non-UK postgrads Enrolments 2013-14	36
	N STEM first degree with honours, qualifiers 2013-14	36
	N STEM Doctorates 2013-14	33=
Knowledge assets	Inventor population with patents 5 -10 years old in Oct 2014	36
	Total publication output past 2 years	35
	HE-BCI total income per HE academic 2010/11-2012/13	31
Enabling structures	%FTE in 9 or 11 Industry Strategy sectors 2012	39
	%FTE in 5 science & technology sectors (ONS) 2013	36
Environment	Net business birth and death rates 2012	31
	Employment rates 16-64 yrs 2013-14	19=
	Halifax quality of life survey 2014	31=
	Mean gross FT earnings workplace 2014	19
	Superfast Broadband availability 2014	38
	Average Broadband download speed 2014	39
	Take-up of lines (% households/premises) 2014	39
	Travel to work times 2012	1
Innovation Outputs	GVA per capita 2013	23
	GVA per hour 2013	36
	UKCIS product/process innovation (% enterprises 2008-10)	38
Average rank		**30.6**

Source: BIS (2015d).

3. The Knowledge-base in Cumbria – Industries and occupations

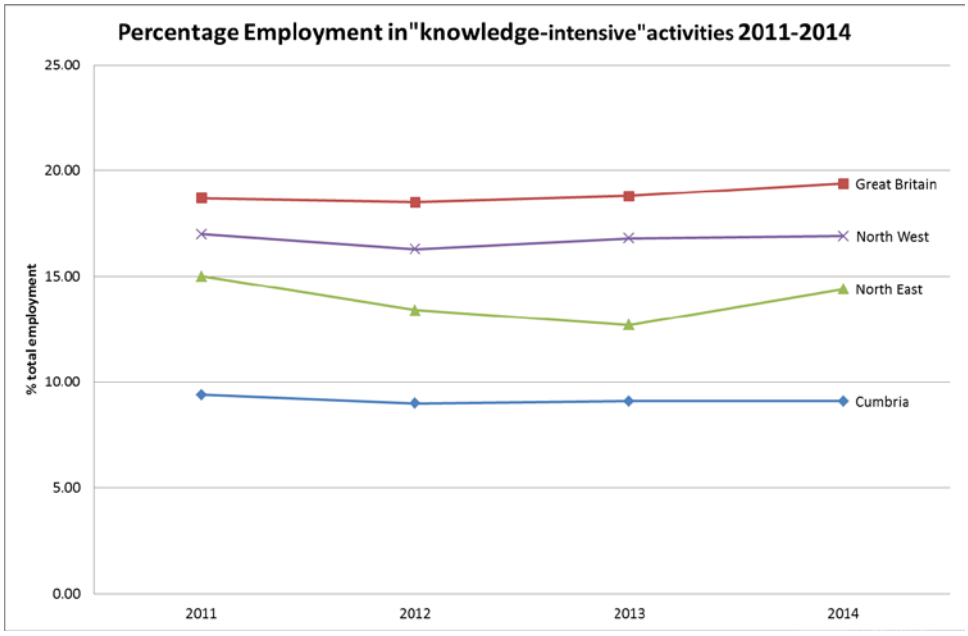
The BIS innovation study indicates that Cumbria appears to rank very low for the presence of “science and technology” sectors as measured by employment. Cumbria is, in fact the lowest ranked LEP in relation to the Industry Strategy Sectors as defined by national government priorities. This analysis, however, can be challenged on the grounds that there is no one clear definition of what defines sectors that are conducive to interaction and innovation. These measures appear to be influenced mostly by central government sectoral priorities rather than any intrinsic qualities that sectors may possess. Different definitions can yield very different results. To illustrate this point, it could be argued that innovation is associated with “knowledge-intensive sectors” – those that are closely associated with processing of information, information technology and the distribution and exchange of information held. One such classification is shown in Table 2.

Table 2: Knowledge-Intensive Sectors (Standard Industrial Classification, 2010)

SIC	**Research & Development**
72	Scientific research and development
	ICT related
61	Telecommunications
62	Computer programming, consultancy and related activities
631	Data processing
262	Manufacture of computers and peripheral equipment
	Media related
18	Printing and reproduction of recorded media
58	Publishing activities
263	Manufacture of communication equipment
591	Motion picture, video and television programme activities
60	Programming and broadcasting activities
639	Other information service activities
	Knowledge-intensive services
64	Financial service activities, except insurance and pension funding
65	Insurance, reinsurance and pension funding, except compulsory soc security
66	Activities auxiliary to financial services and insurance activities
69	Legal and accounting activities
70	Activities of head offices; management consultancy activities
74	Other professional, scientific and technical activities
82	Office administrative, office support and other business support activities
91	Libraries, archives, museums and other cultural activities
732	Market research and public opinion polling
711	Architectural and engineering activities and related technical consultancy
712	Technical testing and analysis
731	Advertising
	Higher Education
854	Higher education

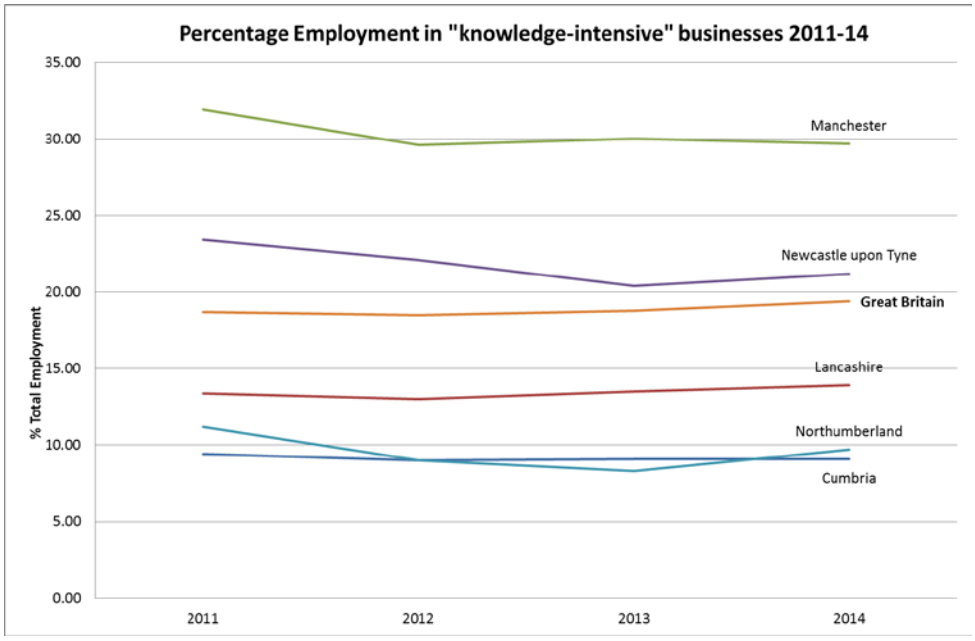
Official employment data (BRES) shows that these sectors combined account for 9.1 percent of employment in Cumbria. This figure is significantly lower than the national average (19.4%) and the equivalent figure for the north-west and north east regions of England (see Figures 1 and 2). As might be expected, knowledge-intensive businesses appear to be a much more significant part of the economy of the larger cities in north-west England. However, Table 3 shows that the Cumbrian figure compares favourably with several of the smaller boroughs within Merseyside and Greater Manchester and also some local authorities across Lancashire. Table 4 shows that the most prominent activities in Cumbria defined as “knowledge-intensive” includes management consultancy, architecture and associated engineering activities, legal and accounting services, finance and office administration as well as computer programming and other professional & scientific activities.

Figure 1



Source: BRES Employment data accessed via NOMIS

Figure 2



Source: BRES Employment data accessed via NOMIS

Table 3: Significance of Employment in Knowledge-intensive sectors in NW England, 2014

Area	% Employment in Knowledge-intensive businesses
Manchester	29.7
Trafford	23
Salford	22.9
Cheshire East	22.5
Cheshire West and Chester	22.2
Stockport	19.6
Liverpool	19.4
Great Britain	**19.4**
Halton	18.8
Warrington	18.4
Bolton	15.9
Bury	14.8
Lancashire	13.9
Sefton	12.9
Wirral	12.2
Blackburn with Darwen	11.1
Wigan	10.8
Oldham	9.6
Cumbria	**9.1**
St. Helens	9
Rochdale	8.8
Tameside	8.6
Blackpool	8.5
Knowsley	8.3

Source: BRES Employment data accessed via NOMIS

Table 4: Employment in "knowledge-intensive" industries in Cumbria, 2013

70 : Activities of head offices; management consultancy activities	3,780
711 : Architectural and engineering activities and related consultancy	3,240
69 : Legal and accounting activities	3,143
64 : Financial service activities, except insurance and pension funding	1,751
82 : Office administrative, office support and other business support	1,696
62 : Computer programming, consultancy and related activities	1,211
74 : Other professional, scientific and technical activities	1,162
91 : Libraries, archives, museums and other cultural activities	923
854 : Higher education	911
712 : Technical testing and analysis	871
58 : Publishing activities	662
66 : Activities auxiliary to financial services and insurance activities	647

Source: BRES Employment data accessed via NOMIS

Data on employment by sector, however, can be misleading due to the fact that many scientific and technical workers are employed by firms that would not necessarily be classified in knowledge-intensive sectors. As one example, the Pirelli factory in Carlisle employs many workers with scientific knowledge but these would all be classified under "rubber and plastics" within official employment data. Fortunately, a complementary indicator of local industrial structure is provided by *occupational* data derived from the Annual Census of Population. This is based on a sample survey and margins of error are fairly high at local levels. Even so, this source gives us an "order of magnitude" for the proportion of workers identified as "Managers and Directors", "Professional Occupations" and "Associated Professional and Technical Occupations". Table 5 shows that approximately 84,000 workers are in these three categories in Cumbria representing 35% of total employment. This is a lower proportion compared to most other local Authority areas in the north-west region, but by no means the lowest ranked area (see Table 6). It is also the case that in terms of absolute numbers, Cumbria has more workers in these categories than most of the boroughs in the Mersey-Manchester belt.

Table 5: Occupational Structure in North West England (Number of Employees), 2015

	Managers, directors & senior	Professional occupations	Associate prof & tech occupations	Total
Lancashire	50,900	94,400	63,400	208,700
Manchester	19,000	54,000	24,400	97,400
Cheshire East	23,700	39,000	26,200	88,900
Cumbria	**26,700**	**34,200**	**23,900**	**84,800**
Liverpool	15,600	45,600	21,400	82,600
Cheshire W & Chester	18,700	29,400	23,200	71,300
Stockport	15,600	34,000	18,200	67,800
Trafford	13,800	32,100	16,800	62,700
Wirral	11,500	30,900	17,000	59,400
Wigan	13,800	19,800	22,000	55,600
Sefton	13,300	21,800	18,400	53,500
Bolton	12,300	22,300	15,400	50,000
Warrington	11,700	19,600	16,100	47,400
Salford	11,600	16,000	14,400	42,000
Bury	8,500	18,000	13,100	39,600
Tameside	8,100	16,600	12,700	37,400
Rochdale	7,800	14,100	9,500	31,400
Oldham	7,500	13,300	10,400	31,200
St. Helens	6,500	12,700	8,100	27,300
Blackburn with Darwen	5,000	9,500	6,500	21,000
Knowsley	3,500	8,700	7,500	19,700
Blackpool	5,300	7,800	6,100	19,200
Halton	3,900	7,100	7,800	18,800

Source: Annual Census of Population accessed via NOMIS

Table 6: Occupational Structure in North West England (% of Employees), 2015

	Managers, directors & senior	Professional occupations	Associate prof & technical occupations	Total
Trafford	12	28	15	55
Stockport	11	24	13	48
Cheshire East	13	21	14	48
Warrington	12	19	16	47
Bury	10	21	15	46
Cheshire W & Chester	12	19	15	46
Wirral	8	23	12	43
Manchester	8	24	11	43
Sefton	10	17	15	42
Liverpool	8	23	11	42
Bolton	10	17	12	39
Lancashire	9	17	12	39
Tameside	8	16	13	37
Salford	10	14	13	37
Rochdale	9	16	11	36
Wigan	9	13	14	36
Cumbria	**11**	**14**	**10**	**35**
St. Helens	8	16	10	34
Blackburn with Darwen	8	15	10	34
Oldham	8	14	11	33
Blackpool	9	13	10	33
Knowsley	6	14	12	32
Halton	7	12	13	32

Source: Annual Census of Population accessed via NOMIS

4. New start-up businesses

The BIS (2015a) study includes business birth and death rates as indicators of the general environment for innovation. This seems plausible given that most definitions of innovation refer to "changes and improvements" in business products, services or processes. Arguably, a business start-up can be classed as innovation almost by definition. This needs some caution in interpretation given that new businesses will vary considerably in terms of the level of sophistication of products and their relative "newness". Many new starts will not be based on new high technology products, although a recent study of innovation in SMEs in North West England identifies several businesses of this type operating in Cumbria (BIS 2014b). There are also ambiguities surrounding survival rates and the extent to which longevity indicates high or low levels of innovation.

With these caveats in mind, one can see from Table 7 the number of new start-up businesses derived from official new registrations for VAT and/or PAYE. In the UK as a whole, there was a decline from 2004-06, a rise in 2007, followed by a fall from 2008-10 and then a steady rise thereafter. The same pattern is followed in Cumbria and in Tyne and Wear but was not repeated in Durham.

Trends in new company formation can also be monitored using data on company registrations at Companies House. Research by Inform Direct indicates that 2014 saw a continued rise in company formations in Cumbria, with 2,372 new companies started. The greatest number of these (538) was in South Lakeland, 505 in Allerdale, 477 in Carlisle, 385 in Barrow-in-Furness, 254 in Copeland and the smallest number in Eden (213). This geographical distribution has not remained the same over the years and the number of new business formations in Eden and South Lakeland continually dropped from 2004-2012. Cumbria is ranked 42nd for company formation in the list of counties in the UK which is a rather low ranking.

Companies House data also shows that the *rate of new company formation* (proportion of new companies to total companies in the area) was 13% in Cumbria in 2014, compared to 12% in Dumfries & Galloway and the Scottish Borders but lower than Cumbria's English neighbours of Northumberland (15%), Lancashire (16%) and Durham (17%). As noted above, it is not easy to interpret these patterns. Lower rates of new company formation do not necessarily equate to a poorer quality environment for innovation. Indeed, Cumbria is known for high survival rates in business arguably indicating that companies are somewhat "longer lived" in Cumbria perhaps due to continual innovation within them. Hence, the number or change in number of start-ups can be a poor proxy for innovation. Table 8 which shows rates of start-up using the ONS data confirms this conclusion. On average, Cumbria has a low rate of business births (11.4), but death rates are also lower than other areas which reflects the fact that the County has a relatively high survival rate for existing businesses.

Table 7: Numbers of new start-up businesses per annum, 2004-13

Area			Year			Area			Year		
	2004	2005	2006	2007	2008		2009	2010	2011	2012	2013
UNITED KINGDOM	280,080	274,855	255,530	280,730	267,445	**UNITED KINGDOM**	236,030	235,145	261,370	269,565	346,485
ENGLAND	248,450	241,410	225,120	246,700	236,345	**ENGLAND**	209,035	207,520	232,460	239,975	308,770
NORTH EAST REGION	7,645	7,655	7,090	8,795	7,675	**NORTH EAST REGION**	6,625	5,975	7,070	7,265	9,685
Durham County	1,530	1,540	1,410	1,725	1,445	County Durham UA	1,250	1,130	1,305	1,255	1,690
Northumberland County	1,050	1,025	945	1,115	1,065	Northumberland UA	890	840	890	910	1,215
Tyne and Wear Metropolitan County	3,280	3,245	2,990	3,585	3,150	Tyne and Wear Metropolitan County	2,755	2,460	2,935	3,120	4,160
Cumbria County	2,595	2,180	2,105	2,385	1,950	Cumbria County	1,580	1,340	1,585	1,705	2,190
Allerdale	485	375	375	445	345	Allerdale	285	235	320	320	430
Barrow-in-Furness	325	240	220	325	275	Barrow-in-Furness	190	140	200	220	305
Carlisle	485	480	450	435	355	Carlisle	315	300	295	310	460
Copeland	275	195	190	330	265	Copeland	215	170	215	290	330
Eden	315	260	245	245	210	Eden	175	165	160	150	190
South Lakeland	710	630	625	605	500	South Lakeland	400	330	395	415	475
Lancashire County	5,935	5,445	4,725	5,180	4,725	Lancashire County	3,930	3,695	4,145	4,125	5,210

Source: ONS Business Demography statistics

Table 8: Business Birth and Death Rates for 2013 calculated using ONS Business Demography Data

	Births	Deaths	Stock	Birth rate	Death rate
UNITED KINGDOM	346,485	237,660	2,448,745	14.1	9.7
GREAT BRITAIN	341,630	232,540	2,392,965	14.3	9.7
ENGLAND AND WALES	320,090	217,630	2,230,735	14.3	9.8
ENGLAND	308,770	209,465	2,140,985	14.4	9.8
NORTH EAST REGION	9,685	6,470	65,890	14.7	9.8
Durham County	1,690	1,125	12,370	13.7	9.1
Northumberland County	1,215	900	9,750	12.5	9.2
Tyne and Wear Metropolitan County	4,160	2,725	26,985	15.4	10.1
Cumbria County	2,190	1,615	19,245	11.4	8.4
Allerdale	430	305	3,505	12.3	8.7
Barrow-in-Furness	305	190	1,995	15.3	9.5
Carlisle	460	335	3,650	12.6	9.2
Copeland	330	180	2,180	15.1	8.3
Eden	190	190	2,450	7.8	7.8
South Lakeland	475	415	5,465	8.7	7.6
Lancashire County	5,210	4,035	41,330	12.6	9.8

Source: ONS Business Demography statistics

5. R & D Expenditures and Tax Credits

The most reliable estimates of national research and development spending which draw together information on research and development spending in the public and private sectors, that is, business enterprises, government, higher education and private non-profit businesses, can be found in survey results published by National Statistics. These also show which sectors are providing funding to research and development spending in the UK, and, in addition, can be categorised into civil and defence expenditure. The latest statistics were published on 20th March 2015. The data is collected by BIS from a sample survey of around 4,000 businesses. In most cases, the spatial data refers to the actual location of the R&D activity and not just company headquarters.

Until recently, this data has only been published at regional scale. Hence, out of a total of £2.5 billion spent on R & D in the North West of England in 2013, approximately £1.8 billion was spent by businesses and £0.6 billion by the Higher Education sector. The remaining amount was spent by Government and by private, non-profit making businesses. However, recent interest in the performance of Local Enterprise Partnerships has increased interest in patterns at County level and some of this data has now been released for 2013. Table 9 ranks expenditure of R&D in UK businesses by LEP area. This shows the dominance of London and the outer South-East for private investment in R&D but there are significant outliers in Cheshire and Warrington and the north Midlands. Northern cities are mostly in mid-table while the more peripheral and rural counties lag behind. Cumbria is ranked 35th with annual expenditure dedicated to formal private sector R&D amounting to only £65m.

Other types of administrative data can be used to complement this survey data. In particular, Inland Revenue maintains records of tax credits claimed by businesses for R&D activity. National Statistics publish this information though only at the regional scale, showing the number of claims and values for R & D tax credit.[2]

The number of claims for tax credit for R & D expenditure made by firms in the North West of England for the tax year 2013-2014 was 1,905 and which amounted to £105 million credit. However, this regionalisation is based on registered office location, which may not be where the actual R&D activity was carried out. Figure 3 gives the regional breakdown for the UK. The number of claims has risen nationally every year since such tax credits were introduced in 2000-2001.

There is also a breakdown by sector of the national figure which shows that Manufacturing; Information and Communication; and Professional, Scientific and Technical sectors, account for 31%, 26% and 19% of the total amount of R & D tax credits claimed, respectively. However, one must note that the coding of industry sectors is based on the SIC of the firm applying and therefore does not always reliably describe the sector of that company's' R&D activity.

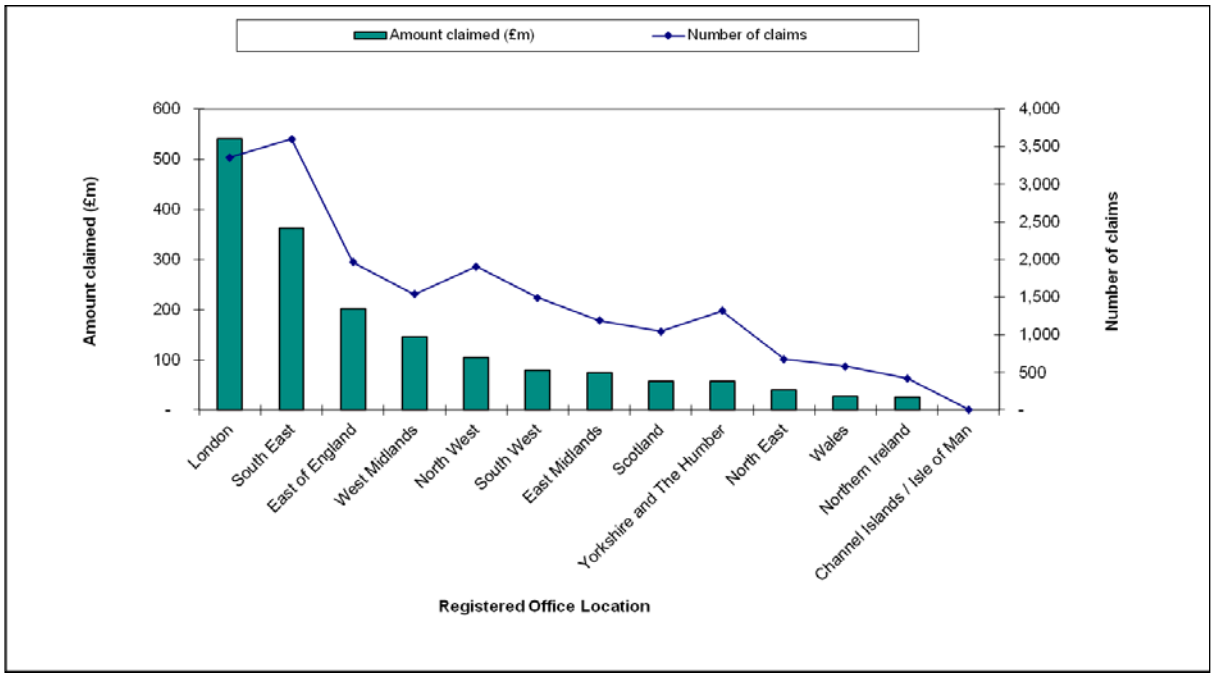
[2] C.f. HMRC (2015) Table RD5 looks at the regional split of R&D claims. However, this is based on registered office location, which may not be where the actual R&D activity is carried out.

Table 9: Expenditure on R&D in UK Businesses by LEP Areas in 2013 (£m)

1	Greater Cambridge & Greater Peterborough	1,332
2	Hertfordshire	1,322
3	London	1,317
4	Enterprise M3	1,180
5	Coventry and Warwickshire	1,070
6	Thames Valley Berkshire	1,042
7	Cheshire and Warrington	1,035
8	Derby, Derbyshire, Nottingham and Nottinghamshire	968
9	South East	957
10	Solent	713
11	South East Midlands	647
12	New Anglia	641
13	West of England	464
14	Leeds City Region	440
15	Swindon and Wiltshire	417
16	Oxfordshire LEP	411
17	Buckinghamshire Thames Valley	354
18	Coast to Capital	319
19	Greater Birmingham and Solihull	282
20	Liverpool City Region	274
21	Gloucestershire	250
22	North Eastern	208
23	Greater Manchester	206
24	Lancashire	204
25	Heart of the South West	200
26	Leicester and Leicestershire	197
27	York and North Yorkshire	186
28	Worcestershire	164
29	Northamptonshire	162
30	Stoke-on-Trent and Staffordshire	155
31	Humber	109
32	Sheffield City Region	104
33	Dorset	102
34	Tees Valley	101
35	Cumbria	65
36	Black Country	59
37	Greater Lincolnshire	50
38	The Marches	46
39	Cornwall and the Isles of Scilly	19

Source: ONS

Figure 3: Registered office regional analysis of R & D tax credit claims, 2013-14



Source: HMRC (2015), p. 11

6. Numbers of Patent Applications

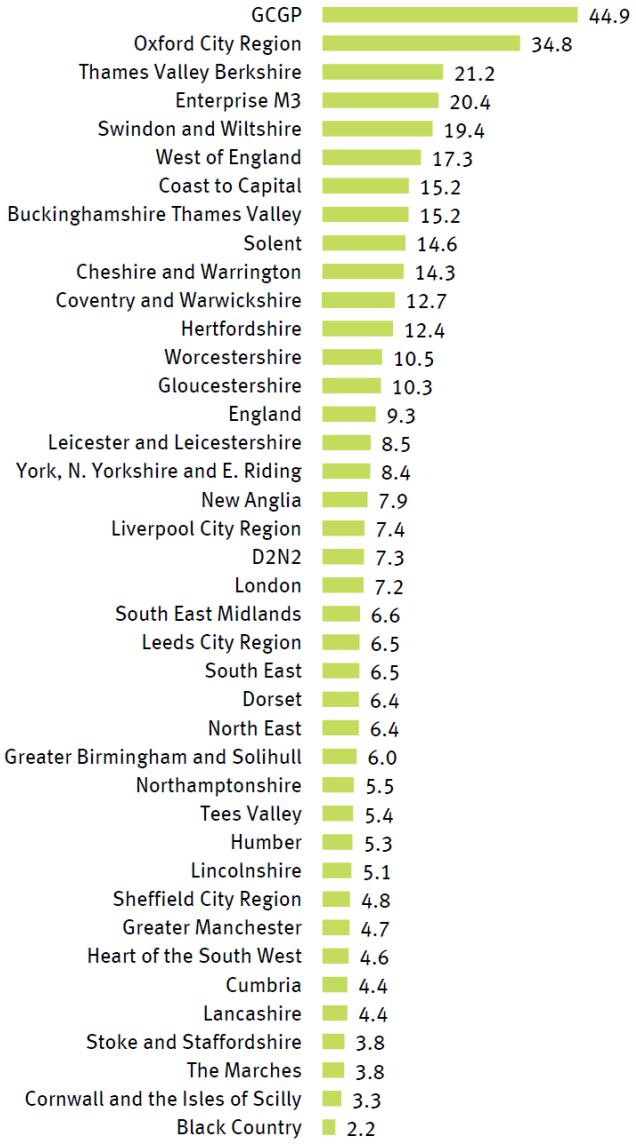
Data on patents is also useful for mapping innovative performance. A recent review of indicators for the LEPs[3] has included analysis of data from the European Patent Office held on EUROSTAT and OECD. This reveals a very similar rank position for Cumbria across a range of related indicators. Figure 4 shows that the average annual number of patents per 100,000 residents attributed to Cumbria over the 5 years from 2007 to 2011 was only 4.4 and the County ranked 34th out of the 39 LEPs. The overall picture is very similar to patterns of R&D spend with significant numbers of patents in the South-East of England and relatively low rankings even for the major conurbations in the north of England. The most recent patent data from OECD available online is for 2011 (see Table 10). This shows 21.5 Patents in the year, split roughly equally between east and west Cumbria.

More recent data is less easily available. However, Innovus has published figures on the number of inventions that have been lodged by firms in Cumbria in 2015 (this is pre-patent application).

- Allerdale, 61 disclosures and £582,000 of investment.
- Copeland, 35 disclosures and £463,000 of investment.
- Eden, 25 disclosures and £531,000 of investment.
- Barrow-in-Furness, 51 disclosures and £79,000 of investment.
- Carlisle, 20 disclosures and £52,000 of investment.
- South Lakeland, 29 disclosures and £33,000 of investment.

[3] The LEP Network (2014) Building Local Advantage Review of Local Enterprise Partnership Areas Economies 2014

Figure 4: Average Annual Patents (over the 5 years 2007-2011) per 100,000 residents



Source: LEP Network (2014) "Building Local Advantage," p. 56

Table 10: Patent applications by region, 2011

UKC14: Durham CC	56.6
UKC21: Northumberland	34.3
UKC22: Tyneside	52.9
UKC23: Sunderland	6.2
UKD11: West Cumbria	10.4
UKD12: East Cumbria	11.1
UKD41: Blackburn with Darwen	8.3
UKD42: Blackpool	0.3
UKD43: Lancashire CC	48.4

Source: OECD Statistics

These figures partly reflect Innovus networks of the West coast of Cumbria though there are proactive plans to encourage disclosures across the whole County. A total of £1.82 million was invested by Innovus in innovative projects in 2015.

7. The UK Innovation Survey

The indicators shown in the previous sections focus very much on the commercialisation and formal R&D processes. As noted in definitions, however, the concept of "innovation" is much broader than this and reliance on these formal measures (R&D budgets, Patents) will tend to overlook much of the innovation that lies behind the competitiveness of SMEs in particular. Capturing this wider context is challenging for data collection but there are surveys that seek to quantify this aspect. The UK Innovation Survey is conducted every two years by the Office for National Statistics on behalf of the Department of Business Innovation & Skills (BIS). The information ultimately feeds into the Community Innovation Survey (CIS). CIS allows the monitoring of Europe's progress in the area of innovation. Data is available for researchers from the Virtual Micro-Data Laboratory (VML) and from the Secure Data Service (SDS).[4]

The definition of innovation activity includes any of the activities described below that enterprises are engaged in during the survey period. These activities are as follows:

- Introduction of a new or significantly improved product (good or service) or process;
- Engagement in innovation projects not yet complete or abandoned;
- New and significantly improved forms of organisation, business structures or practices and marketing concepts or strategies;
- Activities in areas such as internal research and development, training, acquisition of external knowledge or machinery and equipment linked to innovation activities.

Furthermore, a business that had engaged in any of the activities described in points 1 to 3 given above is defined as being 'innovation active'. A business that had engaged in any of the activities described in points 1 to 4 given above is defined as a "broader innovator." The businesses classed as a "wider innovator" are those that have engaged in the activity described in point 3 given above.

From a population in 2013 of approximately 187,000 businesses with more than 10 employees from various industrial sectors and regions in the UK, a sample of approximately 28,400 businesses was sent survey questionnaires. Responses were received from over 14,000. The survey includes sections on factors that hamper innovation, the impact of innovation on the business and the sources of information used. It also touches on aspects of the wider innovation process, such as the introduction of new management techniques.

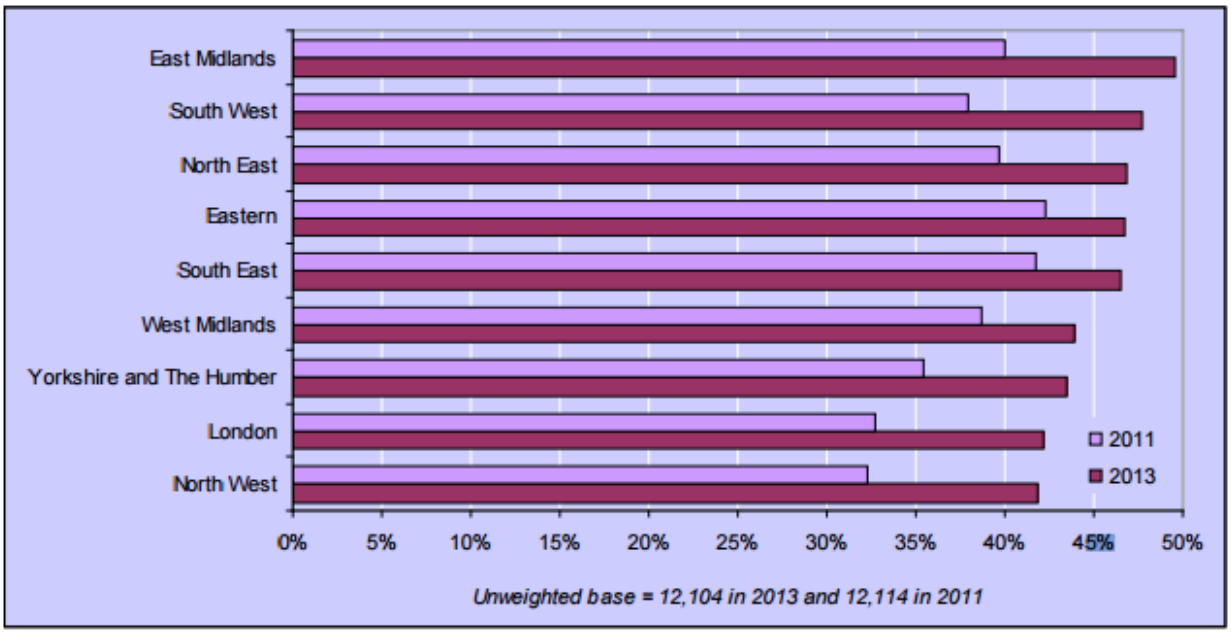
This data is routinely published only at regional levels in the UK (see Figure 5). There were eight percentage points between the least and most 'innovation active' region in the UK. Although the East Midlands region had the highest proportion with almost 50 per cent, this was closely followed by the South East (48 per cent), Eastern (47 per cent), North East (47 per cent) and South West (47 per cent). The North West and London regions had 42 per cent which were the lowest shares. However, the share of all regions went up notably since the 2011 survey with increases of five to ten percentage points between this survey and the last one. The share of large firms (those with more than 250 employees) classified as

[4] Details on how to access the VML and SDS can be found here: http://www.ons.gov.uk/ons/aboutons/business-transparency/freedom-of-information/what-can-i-request/virtual-microdata-laboratory--vml- /index.html and http://www.data-archive.ac.uk/home

'innovation active' was higher than small and medium enterprises (SMEs): 50 per cent versus 45 per cent of SMEs. The same difference also existed between large firms and SMEs in the 2011 survey. 18 per cent of firms reported engagement in product innovations and one in ten firms reported engaging in process innovations. The forms of innovation engaged in can be seen in Figure 6.

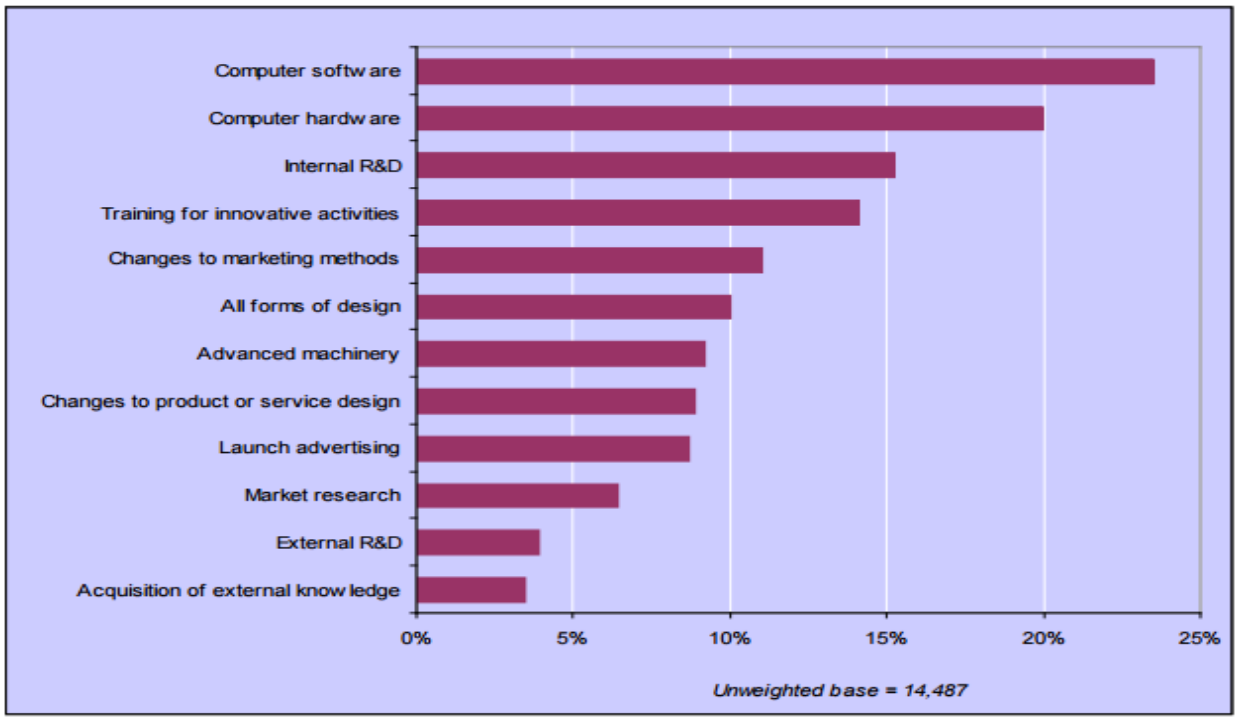
The most commonly reported activities were acquisition of computer software and hardware (23 per cent and 20 per cent, respectively) and these proportions went up from 19 per cent of computer software and 16 per cent of hardware in the 2011 survey. The proportions of each type of innovation expenditure in total expenditure on innovation in the UK in 2013 can be seen in Figure 7.

Figure 5: Shares of innovation active businesses by region (all enterprises)



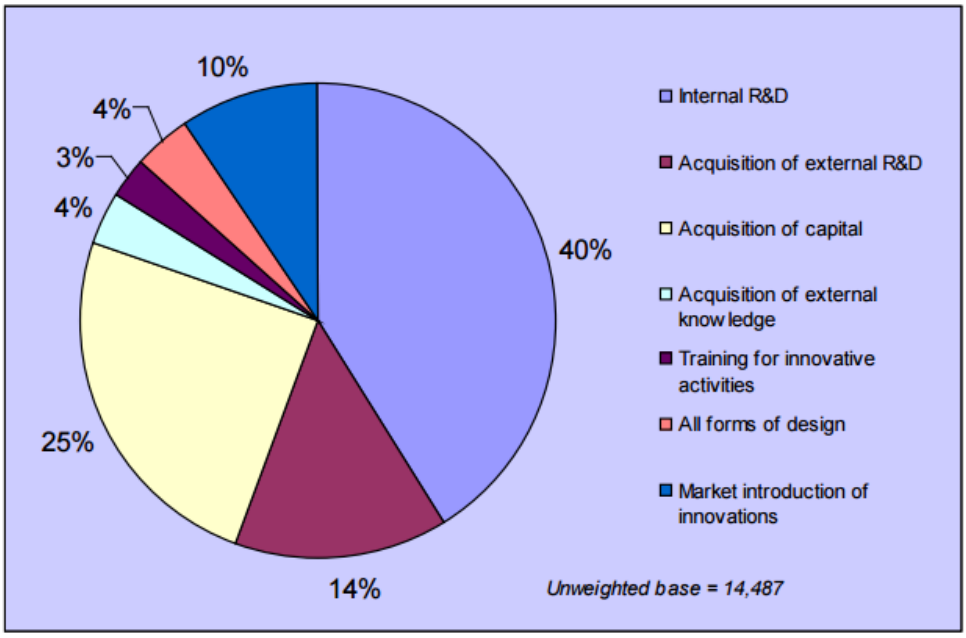
Source: BIS (2014b), p. 16

Figure 6: Innovation activities invested in (all enterprises)



Source: BIS (2014b) p. 7

Figure 7: Types of Innovation expenditure in 2012 (as a proportion of total expenditure)



Source: BIS (2014b), p. 8

As previously stated, the Innovation survey is not normally published below regional level partly due to issues surrounding sampling and margins of error. However, some restricted use has been made of sub-regional data from the Innovation Survey to construct data to compare the English LEPs. Table 11 shows the rank order of LEPs based on the percentage of enterprises involved in product or process innovation 2008-10. This analysis indicates that the proportion of businesses involved in innovation in Cumbria is low and ranked 38 out of 39 LEPs.

Table 11: UKCIS – Product or Process Innovation, % of enterprises, 2008-10

Rank	LEP Area		
1	South East Midlands	EM (part SE & EoE)	3rd Tier
2	Hertfordshire	EoE	Lon CR
3	Black Country	WM	2nd Tier
4	Enterprise M3	SE	Lon CR
5	Oxfordshire	SE	Rural
6	Coast to Capital	SE (part London)	Lon CR
7	Derby +shire, Nottingham +shire	EM	2nd Tier
8	The Marches	WM	Rural
9	Cheshire and Warrington	NW	3rd Tier
10	Dorset	SW	3rd Tier
11	Gr Cambridge & Gr Peterborough	EoE (part EM)	3rd Tier
12	Lancashire	NW	3rd Tier
13	North Eastern	NE	2nd Tier
14	Northamptonshire	EM	3rd Tier
15	Leeds City Region	YH	2nd Tier
16	Leicester and Leicestershire	EM	2nd Tier
17	Tees Valley	NE	3rd Tier
18	South East	SE (part EoE)	Lon CR
19	Buckinghamshire Thames Valley	SE	Lon CR
20	Thames Valley Berkshire	SE	Lon CR
21	West of England	SW	2nd Tier
22	Coventry and Warwickshire	WM	3rd Tier
23	Worcestershire	WM	Urban-rural
24	Swindon and Wiltshire	SW	3rd Tier
25	Sheffield City Region	YH (part EM)	2nd Tier
26	Solent	SE	3rd Tier
27	Greater Birmingham and Solihull	WM	2nd Tier
28	Cornwall and Isles of Scilly	SW	Rural
29	Liverpool City Region	NW	2nd Tier
30	London	London	Capital
31	Gloucestershire	SW	Urban-rural
32	Heart of the South West	SW	3rd Tier
33	Greater Lincolnshire	EM (part YH)	Rural
34	New Anglia	EoE	3rd Tier
35	Greater Manchester	NW	2nd Tier
36	Stoke-on-Trent and Staffordshire	WM	3rd Tier
37	Humber	YH	3rd Tier
38	Cumbria	NW	Rural
39	York, North Yorkshire and East Riding	YH	Rural

Source: Enterprise Research Centre (ERC) analysis of the UK Innovation Survey; cited in BIS (2015a).

8. European Union Regional Innovation Scoreboard

Data also exists on innovation designed to facilitate comparisons across the regions of the European Union. The EU produces an annual **Regional Innovation Scoreboard** which is a comparative assessment of innovation performance across NUTS 1 and NUTS 2 regions of the European Union, Croatia, Norway and Switzerland. This data draws partly on sources mentioned above but brings in a wider range of indicators of economic performance. It is also only published for regions in England so not available at County level. Even so, this provides a means of comparing the regional context of Cumbria with other parts of Europe.

Figures for 2011 (see Table 12) show that the North West of England performs above the EU average on the following measures: Business R&D expenditure; SMEs innovating in-house; Public-Private co-publications; Technological innovators; Population with tertiary education but below average on measures of: Public R & D expenditure; Non- R & D innovation expenditure; Innovative SMEs collaborating with others; EPO patents; Non-technological innovators; Employment in medium-high / high-tech manufacturing and knowledge intensive services; and Sales of new-to-market and new-to-firm products. Table 12 also indicates some marked regional differences in performance within England.

Table 12: Regional Innovation Scoreboard, 2011

	NW England	NE England	SE England	East Midlands
Population with tertiary education	0.7	0.64	0.79	0.67
Public R & D expenditures	0.4	0.37	0.52	0.36
Business R&D expenditures	0.67	0.46	0.67	0.56
Non-R & D innovation expenditures	0.49	0.47	0.54	0.51
SMEs innovating in-house	0.52	0.49	0.51	0.57
Innovative SMEs collaborating with others	0.37	0.43	0.38	0.46
Public-Private co-publications	0.65	0.38	0.62	0.44
EPO patents	0.43	0.43	0.57	0.5
Technological (product or process) innovators	0.54	0.51	0.53	0.58
Non-technological (marketing/org) innovators	0.33	0.4	0.44	0.38
Employment in medium/high-tech manufacturing and knowledge intensive services	0.45	0.48	0.88	0.44
Sales of new-to-market and new-to-firm products	0.41	0.38	0.5	0.43

Note: Normalised data per indicator by region (The value of the indicator has been rescaled from a minimum value of 0 for the lowest performing region to a maximum value of 1 for the best performing region)

Source: EU (2012), Annex 5.

9. Qualitative evidence of research and innovation

The data presented in the previous sections tends to lead to the conclusion that innovative activity is at a relatively low level in Cumbria compared to that of other counties. This is the picture painted by rankings on R&D spend, knowledge-intensity in industry, patents and survey results of innovation in SMEs. It would be erroneous to conclude, however, that the R&D and innovation that takes place in Cumbria is of low quality. What the data appears to show is that innovation is *less widespread*, but where it does occur, research and innovation *could still be of high quality and significant for business competitiveness*. This section presents evidence from a variety of sources to illustrate some of the characteristics of innovative activity in the County.

Nuclear-related research and innovation

It is evident from a variety of recent studies, including prominently Sir Andrew Witty's Review of Universities and Growth (BIS 2013)[5] and the BIS (2015a) report on Smart Specialisation in England[6] that research and innovation in the nuclear sector is a national priority and that any discussion on the sector would inevitably involve expertise, skills and capacity within Cumbria. Sir Andrew Witty's report illustrates the need for collaboration between LEPs using the example of the connectivity that exists in the nuclear sector between sub-regions across north-west England including Cumbria.

Sellafield Ltd faces considerable challenges in addressing the need for decommissioning of facilities on the site that require key inputs of research, technological development and innovation at a variety of levels. This has been addressed in part though Sellafield's internal strategies and practices but also through collaboration with a range of external partners including prominently the National Nuclear Laboratory (NNL). NNL operates nuclear technology research facilities at a number of locations across the UK, including the Preston Lab at Springfields, test rig facility at Workington and establishments at Risley (Warrington) as well as Stonehouse and Harwell in the south of England.

The core of NNL however is the Central Laboratory which is being developed at the Sellafield site close to the existing facilities at the Winscale Laboratory. At present, there are active and non-active laboratories in use and there are plans to develop further facilities to work with plutonium and mixed oxide fuel development. When fully commissioned, it is anticipated that the Central Laboratory will have the potential to make a significant contribution to global nuclear research.

NNL, the Nuclear Decommissioning Authority (NDA) and Sellafield Limited are currently collaborating with the Engineering & Physical Sciences Research Council (EPSRC) and a consortium of ten UK universities on 30 separate projects which focus on research on nuclear fuels, treatment of legacy ponds and silo wastes as well as infrastructure characterisation, restoration and preservation. The programme, with an overall value of £8-9 million, is underpinned by a £4.9 million grant from the EPSRC, and is being carried out under the name "Distinctive". This grant is supplemented by additional financial and in-kind support from NNL, NDA, Sellafield Ltd and the universities. Starting in February 2014, the work includes technology development, building fundamental knowledge and developing the next generation of subject matter experts.

Some of this research activity will necessarily be based outside the County, but even so, the research issues focus on aspects of decommissioning at the Sellafield site which will inevitably require engagement with the scientific communities that work in West Cumbria. This extends to test facilities that have been created off-site within the region. In particular, NNL and Sellafield have jointly built a Vitrification Test Rig at Workington – a full scale copy of the core of the Sellafield Vitrification plant used for development purposes. Inside the rig, NNL scientists develop and test improvements to vitrification.

While NNL has links with many Universities nationally, there is a particular connection with Manchester University due to the presence of the Dalton Institute in West Cumbria. The Dalton Cumbrian Facility (DCF) is a state-of-the-art research facility of The University of Manchester's Dalton Nuclear Institute located on the Westlakes Science and Technology Park. DCF provides facilities to carry out high-end research in radiation science and nuclear engineering decommissioning.

[5] BIS (2013) "Encouraging a British Invention Revolution: Sir Andrew Witty's Review of Universities and Growth, October." Final Report and Recommendations.
[6] BIS (2015a) "Smart Specialisation in England: Submission to the European Commission; April."

The need to increase innovation at all levels is evident in Sellafield's engagement in apprenticeship programmes and supply chain development. Sellafield Ltd has been working alongside BIS, the National Skills Academy Nuclear and Cogent Sector Skills Council to develop new and improved apprenticeships. These include three apprenticeship programmes in Nuclear worker (Plant process and decommissioning operatives), Health Physics Monitor and Nuclear Welding Inspection Technician[7]. Sellafield Ltd is also seeking to encourage research and innovation throughout the organisation. This can be evidenced by the level of publicity given to innovation and change in corporate literature and events. Examples include recent innovation awards given to the Land Quality Technical Team at Sellafield (Nuclear Institute Annual Conference, February 2015) and celebration of fellowships from the Institute of Materials, Minerals and Mining awarded to Sellafield employees for their significant contributions to engineering and material science. [8]

Submarines, Subsea technology and advanced manufacturing

Cumbria can also claim considerable innovative capacity related to submarines, subsea technologies and advanced manufacturing. BAe Systems Submarines[9] is the UK's sole manufacturer of the Astute class of nuclear powered submarines provided for the UK Royal Navy.[10] These specialist submarines are built at the Barrow Shipyard but depend on a complex supply chain and research and technical capability across BAe Marine Division which operates from 13 sites across the UK.

South Cumbria also has prominent capability in subsea technologies through Tronic which was acquired by Siemens in 2012. Tronic is a world-leading producer of subsea connectors for the oil and gas industry. Seimens acquisition has involved growth in Ulverston. Siemens has offices and factories throughout the UK and employs nearly 13,000 people nationally with its headquarters in Frimley, Surrey. The company's global headquarters is in Munich, Germany.

Through its acquisition of Tronic, Siemens aims to develop technologies that can operate in water depths of up to 3,000 metres. New investment is being made at the Ulverston site in specialist production facilities and an office complex to house new technical capabilities and capacity. New roles are being created in engineering, project management, production and quality management to support development of new and existing products.

Another prominent example of research and innovation capacity is provided by the operations of Pirelli in the County. The site in Carlisle employs around 750 workers and is Pirelli's European centre for the development of "ultra high performance" tyres for Sport Utility Vehicles (SUVs). In 2011, the firm received a £2m contribution from the Government's Regional Growth Fund to help develop low rolling resistance tyres that cut fuel consumption and a range of innovative, low CO^2 emission, Ultra High Performance car tyres for the UK and export markets.

In their approach to innovation, Pirelli endorse the concept of "Open Innovation" which can be defined as *combining internal and external ideas as well as internal and external paths to market to advance the development of new technologies.*[11] According to company publicity, their model of innovation focuses on partnership with the major car makers for original equipment supply and providing leadership in the use of innovative and green materials.

[7] Source: "Guide for Industry in Cumbria," Winter 2014, p. 13
[8] Source: Sellafield Ltd web site, Corporate News available at: http://www.sellafieldsites.com/2014/12/sellafield-ltd-fellows-honoured/
[9] Source: BAE Systems website.
[10] Source: Guide for Industry in Cumbria, Winter 2014 edition, p. 5
[11] Definition given on the website of OpenInnovation.eu at http://www.openinnovation.eu/open-innovation/

Pirelli also makes use of state-of-the-art modelling and engages in the development of flexible and efficient manufacturing processes incorporating considerable investments in R&D. These claims are substantiated by the existence of over 100 partnerships with car manufacturers, agreements with 14 universities and links to ten relevant applied research centres globally.

Innovia Films[12] provides another case of innovation in Cumbria. Innovia was formed in 2004 as a management buyout from former owners UCB Films based in Wigton. Innovia has invested in new innovation facilities in Wigton that provides research and test facilities operated by scientists from various fields including chemists, chemical engineers, physicists, materials scientists, project managers, regulatory experts, and IT specialists. The company seeks to create a culture of continual innovation in product and process involving meeting specific customer requirements for plastic film with varied specialized properties (such as permeability, colour, durability, flexibility). As a consequence, Innovia has generated a sequence of innovation in films for new purposes in recent years.

As in the Pirelli example, Innovia adopts an "Open innovation" approach to research activity which is driven by the particular needs of customers. The company has collaborative links with a number of industry organisations that specialize in plastics and packaging including the Royal Society of Chemistry (RSC), the Packaging Society (part of the Institute for Materials, Minerals and Mining) and the Centre for Process Innovation (CPI) which seeks to foster open innovation in high value manufacturing.

The examples given above relate largely to R&D activities generated by the larger multinationals that are hosted in Cumbria. It is evident from these examples that while fundamental research activities may be located within headquarters regions elsewhere, there is nonetheless significant research and product testing capability embedded within local production sites that creates high level employment opportunities.

As regards small and medium-sized businesses, survey evidence may indicate that research and innovative activity is less widespread than in other regions, but there are still examples of highly innovative SMEs operating in Cumbria. Examples include companies operating in sectors that are widely regarded as "high technology" including the hydropower manufacturing company, Gilbert, Gilkes and Gordon based in Kendal; Sundog Energy which designs and installs solar photovoltaic systems for buildings throughout Britain based in Penrith; REACT Engineering which designs and develops new technologies for nuclear engineering and decommissioning based in Cleator Moor and Agrileck Manufacturing, a multi-disciplined engineering company operating in Barrow. A range of other sectors are also included, such as A.W. Jenkinson Forest Products in Penrith and companies in the Food and Drink sector such as Hawkshead Brewery at Staveley; The Village Bakery, Melmerby; and Plumgarth's Farm shop near Kendal.

These examples[13] serve to illustrate the key point that while broad comparative indicators suggest that innovative activities are less widespread in Cumbria compared to those in other counties in England, the innovation that does occur is still leading-edge and significant in specific sectors nationally and internationally.

[12] http://www.innoviafilms.com/About.aspx
[13] Examples drawn from the website of Invest in Cumbria

10. Public Sector support for Innovation: Local Scale

Cumbria LEP, Regional Growth Fund (RGF) and European Structural Funds (ESIF)

At County level, the key organisation for economic development is the **Local Enterprise Partnership (LEP).** The role of the LEP is wide-ranging but it clearly embraces responsibility for economic policy related to research, technological development and innovation. Actions on this aspect are a priority for Central Government regarding the need to improve GVA performance (i.e. productivity) as a means to achieve growth in the regions and nationally. Cumbria LEP has had limited direct resources, but it is able to influence the flow of resources from Central Government via the Regional Growth Fund (RGF). There have been notable successes in this regard.

Pirelli was successful in Round 2 in securing £2m to support investment in robotics and computerisation associated with design and manufacture of low carbon-intensive tyres. In the same round, engineering firm Gilbert Gilkes & Gordon received £2.75m towards rebuilding and refurbishing its factory in Kendal which manufactures pumps and hydro-electric turbines. A £5.5m fund has also been created to support new product development in West Cumbria via services provided by BEC.

More recently, £4m was received from the RGF in an announcement made in May 2015. This includes the creation of a fund managed by **Cumbria Chamber of Commerce** to support innovation in manufacturing and business services across the County as a whole. Grant funding is now available up to £1m to support eligible projects. This same announcement also included a £3.5m grant to support investment by the rally firm M-Sport into a £19m car research and development centre and vehicle test track at Dovenby in West Cumbria.

Support for research and innovation will be further strengthened at County level as projects outlined within the 2014 to 2020 European Structural and Investment Funds (ESIF) Growth Programme come on stream. This includes ERDF funding for proposals within the Cumbria LEP area that promote business investment in research and innovation. There is £2 million available for projects that are no less than £500,000 in value. Delivery of this support depends on partnerships across the County including links to key business organisations such as the Chamber of Commerce as well as the Enterprise activities of the **University of Cumbria** working in collaboration with other Universities in North-West England and the training and enterprise development provision within the **Colleges of Further Education** and other **private providers** of skills and training.

While not specifically directed towards research and innovation, there are several initiatives across the County that are part of the Government's "growth agenda" that could be used to stimulate innovation; in reality, there is close correspondence between growth and the need for innovation which is recognised in the schemes that exist. **Cumbria Business Growth Hub** aims to help businesses realise their potential with free business support for growth. The Growth hub was part-financed by European Regional Development Funding and delivered by a group of partners led by Cumbria Chamber of Commerce. The Growth Hub has generated a number of sector-based networks and forums to assist knowledge exchange. Physical Hubs have also been developed to provide facilities to support networking in Carlisle, Whitehaven, Kendal, Ambleside and Barrow-in-Furness.

Fusion Go delivers a business accelerator programme focussed on entrepreneurs, start-ups and businesses looking to move onto the next stage of their growth. Businesses on the Fusion Go accelerator programme can expect to receive mentoring support from business people who have turned their own entrepreneurial skills into business success. Fusion Go has a Basecamp business incubator building in West Cumbria, with additional Basecamp incubators available in North and South Cumbria.

Innovus

Support for research and innovation in the County has recently been enhanced by the creation of Innovus created in 2013 and based at the Energus Campus at Lillyhall, Workington. Innovus is a partnership between NNL and the University of Manchester funded by the NDA, BEC and the Regional Growth Fund. Its purpose is to significantly increase research, development and innovation activity in the County by providing services to technology innovators, entrepreneurs and investors. These services include access to the world class facilities and technical and business support offered by the programme's key partners, The University of Manchester's Dalton Nuclear Institute and the National Nuclear Laboratory (NNL) - as well as access to funding.

Innovus can therefore justifiably be described as an "intermediary" that provides resources to support the development of ideas prior to commercialisation and to connect innovative SMEs with end-users of technologies and sources of public and private funding. Innovus holds regular events bringing together industry experts from a range of target sectors. In 2014, Innovus partnered with Sellafield Ltd to establish an investment fund to enable businesses to develop technologies to accelerate decommissioning at Sellafield. Cumbria has an impressive range of facilities and a key role of Innovus is to enable the SME community to gain access to those facilities where they can help with technology development. For example, the National Nuclear Laboratory's Central Laboratory comprises inactive and active labs. New capabilities are being added with the commissioning of new plutonium laboratories and high active cells. In Workington, NNL's large rig hall provides space for prototyping at any scale.

Innovus, however, is not a nuclear-specific initiative and seeks to significantly increase research, development and innovation activity across Cumbria as a whole. Innovus aims to work with the business support programmes that already exist in Cumbria to help businesses in their growth plans, including the Cumbria Business Growth Hub, and in the west of the county, Britain's Energy Coast's Linkstart programme for new businesses and Backing Business programme for SMEs, as well as the Energy Opportunities Supply Chain Project and the Investing in Business programme. A network of solicitors, IP commercialisation experts and accountants has also been brought together to give access to a wide-ranging platform of professional support.

Given that technology development is expensive which can be a barrier especially for SMEs, Innovus manages an investment fund to assist "Proof of Concept" and "Prototype Development" activities. At present, these investment funds are provided by the Nuclear Decommissioning Authority (via Britain's Energy Coast), Sellafield Ltd and the Government's Regional Growth Fund. All funds invested by Innovus must be matched by applicants with funds from other sources including from customers, investors and the applicant company themselves. For developing proof of concept, up to 60% of total costs for medium-sized enterprises and up to 70% for small and micro enterprises is currently provided. For prototype development, the fund covers up to 35% of total costs for medium-sized enterprises and up to 45% for small and micro enterprises.[14]

Britain's Energy Coast (BEC)

The most long-standing support for business and innovation in West Cumbia is provided by **Britain's Energy Coast,** (BEC). BEC plays a leading role in coordinating delivery of the economic strategy for West Cumbria (The Energy Coast Masterplan). BEC is also a key delivery body for business support and support for energy innovation. BEC provides funding for physical and skill-related regeneration projects and manages a high quality business

[14] UK Innovation Survey (2015)

property service which includes Westlake Science and Technology Park, assets in Lillyhall and workspace in Workington and Blencathra near Keswick.

In addition, BEC has also supported the **Energy Opportunities Supply Chain Project** (EOSCP) which seeks to support SMEs in securing business not only in the nuclear supply chain but also in energy markets in general. EOSCP provides Meet the Buyer services, business consultancy, and facilitation of links to sources of technical advice (e.g. Manufacturing Advice Service; Envirolink, TWI). These services are made available partly via a webportal at (www.eoscp.co.uk).

More specifically, BEC can support grant funding of up to £1,000 to assist businesses with the cost of marketing, training and equipment. Also, the Business start-up Support Programme has supported over 1,200 business start-ups in West Cumbria[15] BEC has opened Fab Lab (fabrication laboratory) facilities at Createc in Cockermouth and West Lakes Academy in Egremont. This, the ninth Fab Lab in the UK, is part of a global movement which aims to nurture innovation and spark invention. The objective of the BEC Fab Lab is to help develop a community of inventors, entrepreneurs and enthusiasts who will benefit both from the facilities and the interaction it will provide, in the process helping to stimulate economic growth.[16]

Britain's Energy Coast Business Cluster (BECBC)

Alongside BEC (and formerly, West Cumbria Development Agency), West Cumbria also hosts a private-sector led "Business Cluster" which is currently referred to as "**Britain's Energy Coast Business Cluster**". BECBC comprises over 220 organisations, ranging in size from sole traders and SME businesses as well as global companies with business interests in West Cumbria. BECBC member benefits include networking, promotion, knowledge sharing, specialist sector groups and relationship development with key stakeholders in the supply chain and Cumbrian economy. It is stated on the BECBC website that the cluster exists as a means for knowledge exchange between businesses for mutual benefit as well as collective actions in lobbying external stakeholders, identifying common training and skills needs as well as joint action to support employment in the local community. The aims are wide-ranging and embrace socio-economic responsibilities, but also include knowledge sharing that is essential for business innovation.

With regard to innovation, BECBC operated via sector groups that provide an invaluable forum for businesses to meet others in their industry, to find out about trends and opportunities and to share information and knowledge with potential partners, clients and suppliers. The current Sector Groups cover construction, manufacturing and nuclear new build, nuclear decommissioning and waste (including Storage) as well as renewable energy. There are also two "cross-cutting" groups that focus on business support and socio economics. There are examples of the benefits of these interactions in sector groups. In the renewable energy group, for instance, members of the cluster are able to learn from one another regarding government policy instruments that affect the market for products and services in this sector. These discussions cover policy measures to generate greater energy efficiency, energy security and reducing carbon emissions.

[15] Source: BEC pamphlet "FREE Business support for new start-ups and existing businesses in West Cumbria," p. 2[15] http://www.innoviafilms.com/About.aspx

[15] Source: BEC pamphlet "FREE Business support for new start-ups and existing businesses in West Cumbria," p. 2.

[16] Source: BEC (2013) Press release

11. Public Sector Support for Innovation: National Scale

Alongside local agencies and the resources that they are able to influence directly, businesses and intermediaries in Cumbria also potentially apply leverage to sources of support and innovation schemes and sources of funding coordinated at national level. The key source of such schemes and funding centres is Innovate UK, the UK Government innovation agency.

Innovate UK

Innovate UK (prior to 2014 known as the Technology Strategy Board) is an executive non-departmental public body, sponsored by the UK Department for Business, Innovation and Skills. In recognition of the significance of innovation for business competitiveness, this body was initially created under the Labour administration in 2007 (as the Technology Strategy Board) but has remained a central element of UK economic policy through subsequent Coalition and Conservative administrations post-2010. Innovate UK's significance for innovation in the UK regions has, in fact, been enhanced since the abolition of the Regional Development Agencies and many innovation and technology schemes previously managed by the RDAs have been centralised under Innovate UK. These include the grants for R&D activities of SMEs and the Innovation Vouchers Scheme.

At first sight, the resources made available to Innovate UK appear to be substantial. Table 13 shows that in 2014-15 alone, grants under various schemes amounted in total to nearly £720m. This resource, however, is spread across the whole of the UK and funding is distributed on a competitive basis. Even on a pro-rata basis (based on population), Cumbria (which has less than 1% of the UK population) might anticipate to benefit perhaps from around £5-6m of this funding. It is important, however, not to underestimate the leverage such funding may create with private sector sources and other public support, for instance, from Europe (Horizon 2020).

Funding under the thematic programmes focuses on societal challenges, cross-cutting competencies, enabling technologies and emerging technologies, some of which will be relevant to capacity in Cumbria particularly with regard to energy. More widespread impact, however, would be associated with proposals submitted by SMEs to the "responsive" interventions where eligible grant schemes are "open" on a rolling basis and businesses can proactively submit bids for grants. One such scheme is the grant for R&D, now branded as "SMART" where SMEs can obtain funding to support R&D in strategically important areas of science, engineering and technology and from which successful new products, processes and services could emerge. Grants are available to support projects involving proof of market, proof of concept or development of prototypes.

Innovate UK also provides funding for Knowledge Transfer Partnerships (KTPs). This concept is very long-standing (initially established in 1975) with the aim of helping UK businesses to improve competitiveness, productivity and performance through better use of the knowledge, technology and skills available within universities and other UK knowledge institutions. Cumbrian institutions have had some recent success in drawing on this funding including KTPs associated with Brathay Trust, REACT Engineering's development of an unique radiation analysis concept and the Freshwater Biological Association's creation of a tool for collating freshwater biological records. A KTP aimed at improving town centre retailing is also nearing completion in Carlisle.

Table 13: Innovate UK Grants Awarded, 2014-15 (£000)

	Gross grant	Co-funding	Net grant
Thematic Interventions			
Energy	25,868	3,070	22,798
Sustainability	6243	1,767	4,476
Built environment	6759	1,063	5,696
Urban living	2623	120	2,503
Food supply	12,640	6,058	6,582
Transport	42,473	18,871	23,602
Space	1,068	951	117
Healthcare	52,436	5,838	46,598
High value manufacturing	19,488	405	19,083
Digital services	13,169	80	13,089
Advanced materials	7,073	-159	7,232
Biosciences	9,656	1,064	8,592
Electronics, photonics & electrical systems	10,800	1,323	9,477
Information & communications technology	9,226	686	8,540
Development	3,709	1,065	2,644
Subtotal thematic	**223,231**	**42,202**	**181,029**
Responsive interventions			
Small Business Research Initiative	6,048	1,091	4,957
European Union	3,464	-2,196	5,660
Grant for Research & Development (SMART)	48,166	0	48166
Knowledge Transfer Networks	11,596	308	11,288
Knowledge Transfer Partnerships	18,360	6,015	12,345
Catapult Centres	143,716	8,188	135,528
Micro and Nanotechnology Centres	919	0	919
Non-core projects	136,104	0	136,104
Vouchers	2,955	921	2,034
Subtotal responsive	**371,328**	**14,327**	**357,001**
GRAND TOTAL	**594,559**	**56,529**	**538,030**

Source: Abstracted from Innovate UK Annual Report and Accounts 2014-2015, p. 54

One of the most significant initiatives in recent years, however has involved the establishment of so-called “Catapult Centres”. Since 2012, Innovate UK has created such Centres where scientists and businesses can work together to increase the pace of innovation in specific sectors. Catapults operate in slightly different ways depending on sectors but they all share a commitment to help businesses to adopt, develop and exploit innovative products and technologies. Catapults are not-for-profit, independent physical centres which connect businesses with the UK’s research and academic communities.

Each Catapult centre specialises in a different area of technology but all operate from physical spaces with facilities and expertise to enable businesses and researchers to collaborate in solving key problems and develop new products and services on a commercial scale. Examples of assistance include developing new manufacturing processes, advice on digital rights protection or new ways to balance energy demands. Catapults are intended to

reduce the risk of innovation, accelerate the pace of business development and thereby create or sustain jobs and growth.

Catapults have been awarded on a competitive basis and therefore reflect the pattern of expertise and the nature of bidding processes rather than any explicit spatial strategy. As a consequence, initial announcements led to a high concentration in the south and midlands with four Catapults in London and others in Didcot, Milton Keynes, Solihull and Birmingham. More recent developments however have evolved plans to establish regional centres coordinated by a lead partner, as for example in precision medicine and Advanced manufacturing.

These centres of excellence bridge the gap between business, academia, research and government, they promote collaboration and knowledge exchange allowing many progressive businesses and organisations to build new partnerships with reduced risks. Catapults create an environment of trust, in which SMEs are happy to come and share thinking and ideas in the knowledge that intellectual property will be managed carefully. A large number of joint research and innovation programmes and projects exist where Catapult centres partner with the research base and business.

BIS, Business Support and the Growth Agenda

While Innovate UK has direct responsibility for nurturing research, innovation and technological development, there are many sources of support, advice and funding that could be used for a similar purpose so long as these supported Government's growth agenda for business, particularly SMEs. In this regard, the Department of Business, Innovation and Skills sponsors a number of schemes and initiatives that could be relevant. Recently, several of these schemes, including the GrowthAccelerator and the Manufacturing Advisory Service (MAS) have been merged into one "Business Growth Service".

The GrowthAccelerator aims to increase the number of high growth SMEs in England by helping them to overcome barriers to growth, some of which will clearly be scientific and technical in nature (R&D, barriers to commercialisation). The GrowthAccelerator provides packages of support that includes business coaching related to raising finance and securing new customers, grants to support development of leadership and management, fast access to other external sources of assistance and funding (such as UK Trade and Industry and InnovateUK)[17]. With Government co-investing in the growth of the business, the contribution from the business is only a one-off fee. GrowthAccelerator reports that 90% of businesses that they have worked with said that they were helped to bring new products and services to market. Participants grew on average at four times the rate of the average SME.[18]

The GrowthAccelerator is now fully aligned with the activities of the Manufacturing Advisory Service (MAS) which has a longstanding presence across the UK. Funded by the Department for Business, Innovation and Skills, MAS has an 80-strong team of expert Manufacturing Advisors on the ground working with management teams to plan long-term strategies, improve processes, bring new products to market and develop their supply chain. In seeking to meet these objectives, MAS and the GrowthAccelerator have made use of other policy instruments designed to support business including prominently providing advice on Intellectual Property and also applications for R&D tax credits[19].

[17] For a recent review of this service, see BIS Research Paper No 189.
[18] Source: http://www.ga.businessgrowthservice.greatbusiness.gov.uk/
[19] The tax credits are administered by H.M. Revenue and Customs. For expenditure incurred on or after 1 August 2008, SMEs could deduct 175% in respect of their qualifying R&D expenditure and the payable tax credit can amount to £24.50 for every £100 of actual R&D expenditure. The rate was further increased in 1 April 2011 to 200% and a payable credit of £25 for every £100 of spend. From 1 April 2014 the rate of R&D payable tax

12. Conclusion

The data analysis presented in this report provides some basis for assessing the position of Cumbria in relation to research, technological development, science and innovation. The data shows that there are many people employed in businesses in Cumbria that might be regarded as "knowledge-intensive" and significant for technological development (approx. 20,700). While there are several thousand such workers however, they represent a lower proportion (9%) of all workers compared to those in other parts of the north-west region and northern conurbations in particular. Occupational data, however, shows that there are many more people employed in managerial, scientific, professional and technical occupations (84,400) than implied by the industry analysis but again, this is also a lower proportion (35%) compared to other areas of north-west England. This suggests, perhaps, that there is more scientific, technical and professional work happening in Cumbria than may be commonly assumed but equally not as much as policymakers and industrialists might hope.

Based on indicators of innovation measures such as R&D expenditures, patents and surveys of SMEs, Cumbria is low in most such rankings nationally. However, qualitative data from published sources suggests that while innovative activity may be less widespread in the County, the R&D that does occur can be high quality and leading edge in particular sectors. A low ranking on innovation indicators does not therefore necessarily mean low quality and nor should it be assumed that the County is in some way a poor location for innovation. Examples cited in this document refute this negative assertion.

The implications of these findings are two-fold. First, there is a need to gather more systematic information about levels of existing R&D and innovation activity across the County. Secondly, there is also a need to promote such practices and to encourage more widespread engagement of businesses in innovation activities that enhance creativity and competitiveness in the local economy.

Finally, this report focuses specifically on measures of business innovation and the types of support available to support changes that lead to business growth. This tends to narrow the definition of "innovation" and the types of indicators used in measurement. It excludes many innovative activities that occur within communities and social settings that underpin economic activity that are more difficult to capture in datasets. Innovation, for instance, in the renewables sector may have other intended outcomes besides growth, including community ownership, resilience, quality of life, environmental sustainability and an increase in local social capital. Some types of business innovation create beneficial social or environmental outcomes (such as reductions in carbon footprint) that are not easily distilled from the rankings presented in this report. These findings need to be evaluated in this context.

credit for loss-making SMEs was increased from 11% to 14.5%. Large companies can deduct 130% in respect of qualifying expenditure incurred from 1st April 2008.

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